(12) UK Patent Application (19) GB (11) 2 233 197 (13) A

(43) Date of A publication 02.01.1991

(21) Application No 9012108.8

(22) Date of filing 31.05.1990

(30) Priority data
(31) 8912491 (32) 31.05.1989 (33) GB

(71) Applicant
Charles Dennis Wells
"Glaed Hame", Pasture Road, Letchworth,
Hertfordshire, SG6 3LW, United Kingdom

(72) Inventor
Charles Dennis Wells

(74) Agent and/or Address for Service
Pollak Mercer & Tench
Eastcheap House, Central Approach, Letchworth,
Hertfordshire, SG6 3DS, United Kingdom

(51) INT CL[5]
A63F 9/22 // A63B 69/36, G06F 15/62 15/72

(52) UK CL (Edition K)
H4T TBAG TBAX T100 T120
G1F F1H
U1S S1172

(56) Documents cited
GB 2091526 A EP 0292903 A2 EP 0085483 A1
US 4706199 A US 4343469 A

(58) Field of search
UK CL (Edition K) G1F F1H F21 F22, G1J J1H2,
H4T TBAG TBAX TCGA TCGD TCGX
INT CL[5] A63B, A63F, G01C, G06F, G09B
On-line databases: WPI

(54) **Computerised topography display system, especially for golf**

(57) A computerised topography display system enables a pictorial plan view of a terrain e.g. a golf course, to be represented on a viewing screen. The greens 20 of a golf course are displayed as zones of different colours, each colour representing a different height band, e.g. 20mm of elevation, of the terrain. Contour lines 26 may be added to indicate the boundaries of the height bands. Preferably, ten to twelve different shades of a colour are used to represent the height bands of each green, thus revealing the slopes of the green.

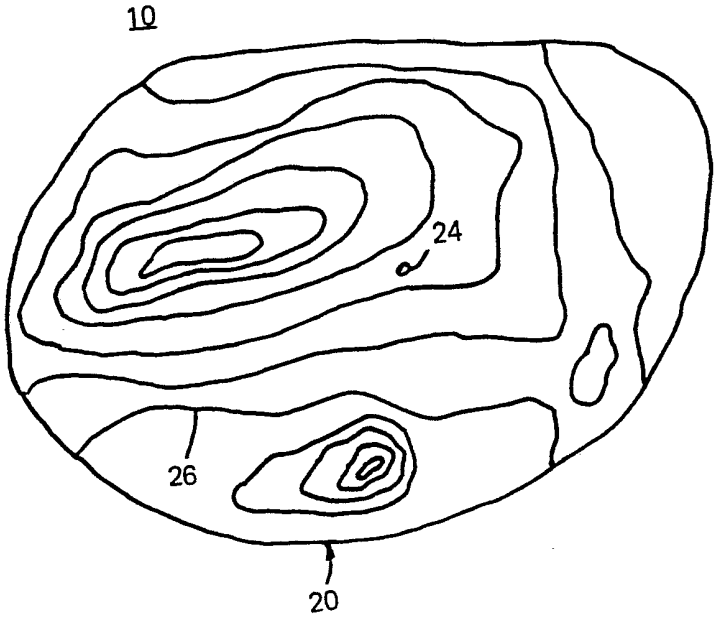
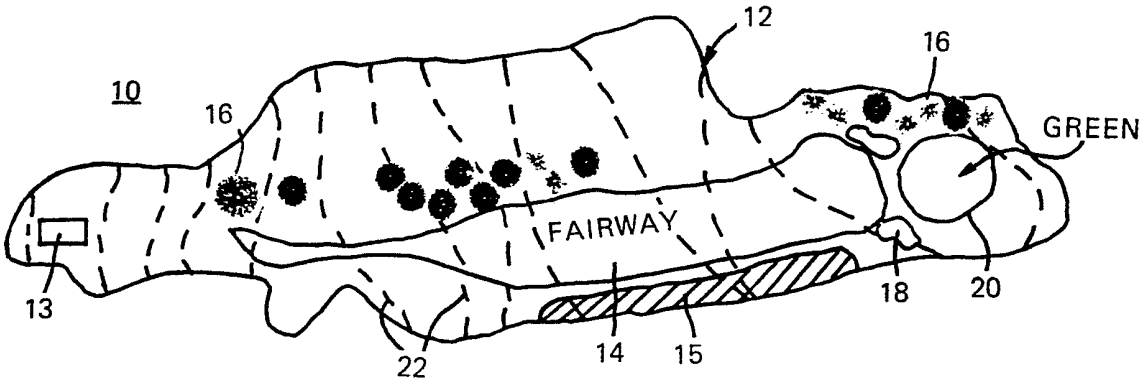


Fig. 2.

GB 2 233 197 A

Fig. 1.



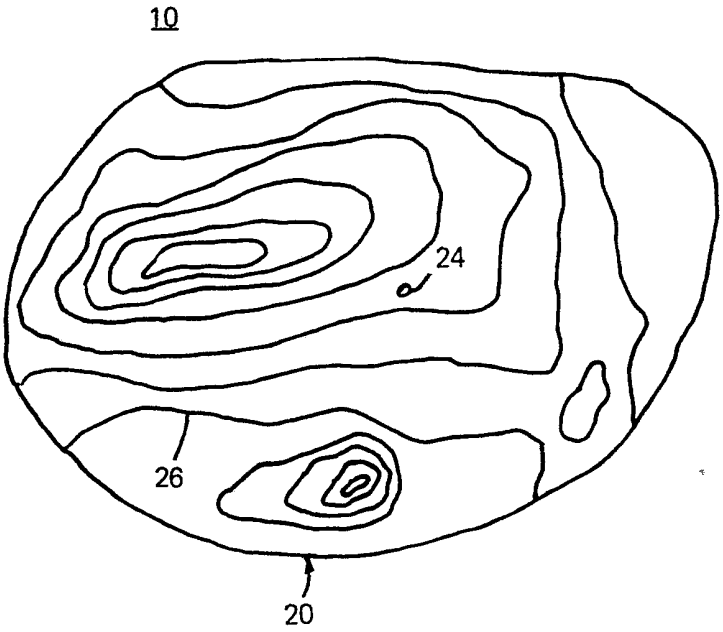
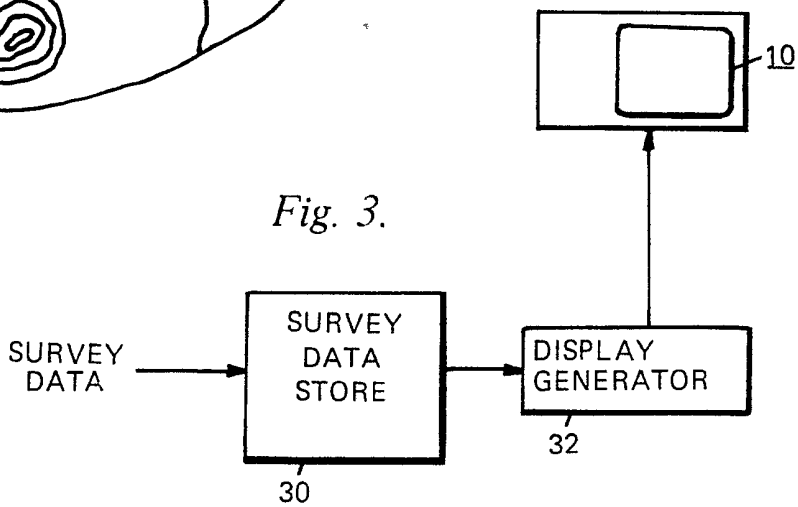


Fig. 2.

Fig. 3.



COMPUTERISED TOPOGRAPHY DISPLAY SYSTEM, ESPECIALLY FOR GOLF

This invention relates to a computerised topography display system, especially for the display of golf courses. It is also concerned with methods of and apparatus for displaying a plan view of the terrain of a surveyed area on a viewing screen, and in particular with a video golf simulator or game.

The references hereinafter to a viewing screen or VDU are intended to include all forms of viewing screen, including television screens for example.

VDUs are used in many situations when it is required to display graphical and/or pictorial information. In particular, such units are inherently useful as a display means for video games. However, the VDU does restrict the authenticity of the game, particularly when it is required to display a pictorial representation of a real-life feature. To overcome the restrictions on the versatility of the VDU, pictorial representations are often presented in side elevation or in perspective. However the effectiveness of the VDU as a means for providing an authentic reproduction of some required feature is still limited.

It is an object of the invention to provide apparatus which increases the range of pictorial representations obtainable on a VDU. In particular, it is an object of the invention to provide apparatus whereby the VDU provides an accurate representation of a real-life sporting venue, pitch, course, terrain or the like.

It is a particular object of the invention to provide such apparatus in a video golf simulation game so as to produce realistic representations of golf courses, for example well-known golf courses.

In accordance with one aspect of the invention there is provided a computerised topography display system comprising storage means arranged to hold data representative of the terrain of a surveyed area, a viewing screen, and means to generate from said stored data a display on the screen of at least part of the surveyed area with display zones of different colours being representative of respective different height bands of the terrain.

Preferably, the different colours are shades of a single colour, with the lightest shade and the darkest shade representing the highest and lowest height bands. Also, additional contour lines representative of smaller height bands may be provided within the individual shade bands.

The display may include contour lines indicative of the boundaries of the different height bands.

In a preferred embodiment the system also includes means to generate from said stored data a display on the screen of at least a part of the surveyed area with display zones of different colours respectively representative of the nature of the surface of the terrain.

In accordance with another aspect of the invention there is provided apparatus for displaying a plan view of the terrain of a surveyed area on a viewing screen, comprising means for representing the plan view as a plurality of zones, each of which zones represents a particular height band of the terrain.

The invention also includes a video golf simulation game comprising storage means holding data representative of the terrain of at least the greens of a golf course, and means to generate from said stored data a display on a viewing screen of said greens with display zones of different colours being representative

of respective different height bands of the greens.

Also in accordance with the invention there is provided a method of representing the terrain of an area in plan view on a viewing screen, which comprises the steps of grid surveying the area and storing data values of elevation for each grid location point, scanning the data to determine the highest and lowest values of elevation, creating within said limits a plurality of bands representative of height increments, and generating from the stored data a display on a viewing screen with display zones of different colours which are respectively representative of different height bands of the terrain.

According to one advantageous aspect of the invention, the screen displays a plan view of the terrain of a particular sporting venue. As such, the screen may display a plan view of a golf course. Particular regions of the golf course only, for example the greens, may be represented.

The invention is described further hereinafter with reference to the accompanying drawings, in which:

Fig. 1 illustrates a screen of a VDU associated with apparatus of the present invention and displaying a particular hole of a golf course in side and plan elevation;

Fig. 2 illustrates the green of the hole of Fig. 1, in plan view, when displayed on the screen; and

Fig. 3 is a schematic diagram of the operation of the system.

A screen 10 of a VDU is represented in Fig. 1 lying in the plane of the drawing. As shown, the screen 10 is displaying a particular hole 12 of a golf course in side and plan elevation. The hole 12 comprises a teeing area 13, fairway 14, rough 15, trees 16, bunkers 18 and a green 20.

A plurality of "contour" lines 22, appearing as white lines for example on the screen, traverse the displayed hole 12. The contour lines 22 divide the displayed terrain into a plurality of regions, each of which regions represents a particular range of height of the golf course. The VDU presentation of the course is very accurate. In order to provide the information for the display, a detailed site survey of each hole of the course has to be carried out, and the course data stored. For the course in general, a 5 metre grid is preferably used. For the greens, a 1 metre grid is preferred. The four corners of each square of the grid are regarded as data points. Each data point is logged in terms of its location, its elevation and if appropriate the nature of the surface. Additional points are stored to define the outline of any course feature, such as bunkers, fairway limits, paths, water, etc. This technique is used to cover the whole surface of the course, as any point within the grids is computed from the adjacent four points. Tree locations are also precise and their spatial element in terms of height and foliage width is included.

The colour presentation is such that the principal features of the hole are distinguishable. For example, different green colour shades from light green to dark green can represent the nature of the surface from the green 20 to the rough 15. The changing levels are shown by the contour lines 22 on the plan view and by actual change of level on the side elevation. The elevation at any point and the nature of the surface at any point are all stored, so that this data is available for recall. The angle of slope and the direction of slope at each survey point are available by computation of the relationship of each point to its adjacent surveyed elevation points.

In playing the video game, the players progress from the tee 13 towards the green 20. Although not described herein, as it is not directly relevant to the present invention, the players have to make various choices and selections for each stroke, including for example choice of club, strength of shot, direction of shot, etc. After leaving the club face, the trajectory of the ball is computed and displayed on the screen. This computation can take into account factors such as wind speed and direction, air temperature, spin, air pressure, ground hardness, ground slope, etc. When all players have reached the green 20, it is displayed separately on the screen 10 as illustrated in Fig. 2. This enlarged representation of the green 20 allows for the relief of the green to be shown in greater detail, for putting purposes.

In Fig. 2, the green 20, having a hole and flag 24, comprises a plurality of regions delimited by lines 26. As with the complete hole 12 illustrated in Fig. 1, the regions between the lines 26 and forming the green 20 in Fig. 2 each represent a particular range of height of the terrain forming the green. Each contour line 26 may represent for example a change of 20mm in elevation from the adjacent contour line. As an alternative, each of the regions may comprise one of a variety of shades of colour, for example green. Further, the shaded regions may illustrate the changes of level over the green 20 without the use of the contour lines 26.

In one particular example, the green 20 may be illustrated by way of twelve different shades of green. Since the golf game may be based on a golf course the holes of which are located at a wide variety of elevations, the difference between the twelve shades of colour on any one green will always correspond to one-twelfth of the total elevation of that particular

green.

The green display of Fig. 2 is generated from the course survey data, and is drawn in plan view as twelve different shades of colour, ranging from light green at the highest areas to dark green at the lowest. The display generating software first scans the green survey data to determine the highest and lowest points, and thus the height bands to be displayed. It then makes a second pass, determining the shade required for each pixel point on the display. The result is that the green is displayed in plan as a fully-filled coloured area, the shades defining the height bands.

The source survey data is pre-processed into evenly spaced spot heights; therefore the green is represented in source form as a height matrix (eg. at one metre intervals). The generation software first determines the minimum and maximum height bounds of the green. From this it determines the display coverage in pixel units, the intention being to display the green as large as possible. The display orientation is the same as the overall hole display.

Having performed this scaling exercise, it can now calculate the number of pixel units to a square metre. These are truncated to an integer value. To form the display it works in metre squares, the height of the four corners being known. Along the X bounds of the square, it assumes linear slope and calculates the "spot" height for each pixel point. It then scans in the Y direction, a line of pixels at a time, again assuming linear slope and using the previously calculated start and finish heights, determines the spot height of each pixel and thus the display colour required.

This is shown schematically in Fig. 3. The survey data is fed into a data store 30 which is connected to

the display generator 32. The output of the display generator 32 is fed to the VDU 10.

As this method does not give any indication of the height range covered, there is an option to display the 20mm interval contour lines 26 overlaid on this display. These may be brown in colour for example and may optically be clipped to the edge of the green, or cover the full display. The interval of these contour lines 26 may be altered if the display is too cluttered. The method of scanning the source data is the same as for the colour-banded display, a brown pixel being drawn each time a 20mm boundary is crossed.

The means for displaying the relief of a green of a golf course according to the present invention allows for a video golf game to be played in which the players take account of the most fundamental factor in determining what direction and strength of putt to play, namely the slope of the ground.

The present invention is particular advantageous since by displaying the nature of the terrain of, for example, a golf course, it is possible to represent a real championship golf course on the screen. A video golf game can thus be provided which can display accurate representations of all eighteen holes of a well-known golf course. This allows for the amateur or professional golfer to play a realistic game of golf on the particular course of his or her choice.

The apparatus may also be arranged to provide an elevational view of the terrain so as to more accurately represent the particular feature being displayed. Thus, with reference to a video golf game, a side elevational view of the hole 12 of Fig. 1 may be represented alongside the plan view shown.

By introducing variables such as weather conditions, ground conditions, choice of club, strength

of shot, hook and slice factor, direction of shot, and spin of the ball it is possible to provide an accurate simulation of a game of golf on the actual golf course represented by way of the VDU.

Although the present invention has been illustrated by reference to a video golf game it is not restricted to the details thereof. For example, the apparatus for displaying terrain according to the present invention may be equally useful when collecting and displaying geological or other scientific data.

Additionally, the present invention is applicable to the presentation of information on a television or cinema screen. It is possible with the present invention to show the viewer a visually intelligible representation of the contours of a green for example, and by indicating the position of a player's ball to explain how the player should approach the putt.

CLAIMS:

1. A computerised topography display system comprising storage means arranged to hold data representative of the terrain of a surveyed area, a viewing screen, and means to generate from said stored data a display on the screen of at least part of the surveyed area with display zones of different colours being representative of respective different height bands of the terrain.

2. A system according to claim 1, in which the different colours are shades of a single colour, with the lightest shade and the darkest shade representing the highest and lowest height bands.

3. A system according to claim 1 or 2, in which the display includes contour lines indicative of the boundaries of different height bands.

4. A system according to claim 1,2 or 3, which also includes means to generate from said stored data a display on the screen of at least a part of the surveyed area with display zones of different colours respectively representative of the nature of the surface of the terrain.

5. Apparatus for displaying a plan view of the terrain of a surveyed area on a viewing screen, comprising means for representing the plan view as a plurality of zones, each of which zones represents a particular height band of the terrain.

6. Apparatus according to claim 5, in which the plurality of zones are separated by contour lines.

7. Apparatus according to claim 5 or 6, in which said zones are represented as different shades of one or more colours.

8. A video golf simulation game comprising storage means holding data representative of the terrain of at

least the greens of a golf course, and means to generate from said stored data a display on a viewing screen of said greens with display zones of different colours being representative of respective different height bands of the greens.

9. A game according to claim 8, in which the different colours are shades of a single colour, with the lightest shade and the darkest shade representing the highest and lowest height bands.

10. A game according to claim 8 or 9, which also includes means to generate from said stored data a display on the screen of each complete hole of a golf course with display zones of different colours respectively representative of the nature of the surface of the terrain.

11. A method of representing the terrain of an area in plan view on a viewing screen, which comprises the steps of grid surveying the area and storing data values of elevation for each grid location point, scanning the data to determine the highest and lowest values of elevation, creating within said limits a plurality of bands representative of height increments, and generating from the stored data a display on a viewing screen with display zones of different colours which are respectively representative of different height bands of the terrain.

12. A computerised topography display system, substantially as hereinbefore described with reference to the accompanying drawing.

13. Apparatus for displaying a plan view of the terrain of a surveyed area on a viewing screen, substantially as hereinbefore described with reference to the accompanying drawings.

14. A video golf simulation game, substantially as hereinbefore described with reference to the

accompanying drawing.

15. A method of representing the terrain of an area in plan view on a viewing screen, substantially as hereinbefore described with reference to the accompanying drawing.

Published 1990 at The Patent Office, State House, 66 71 High Holborn, London WC1R 4TP. Further copies may be obtained from The Patent Office. Sales Branch, St Mary Cray, Orpington, Kent BR5 3RD. Printed by Multiplex techniques ltd, St Mary Cray, Kent. Con. 1/87